

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE  
General Certificate of Education  
Advanced Subsidiary/Advanced



CYD-BWYLLGOR ADDYSG CYMRU  
Tystysgrif Addysg Gyffredinol  
Uwch Gyfrannol/Uwch

311/01

**BIOLOGY**

**MODULE BI1**

A.M. MONDAY, 10 January 2005

(1 hour 30 minutes)

**For Examiner's Use Only**

<b>Total Marks</b>	
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## INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

## INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

1. (a) Using an example from the list below complete the following table. You can use the same example more than once or not at all.

magnesium, sodium hydrogen carbonate ( $\text{NaHCO}_3$ ), red blood cell,  
starch, amino acid, muscle, leaf.

	<i>Example</i>
organic molecule	
tissue	
inorganic compound	
element	
polymer	

[5]

- (b) Give **two** structural differences between the following pairs of molecules:

(i) starch and cellulose;

[2]

.....  
.....

(ii) triglyceride and phospholipid.

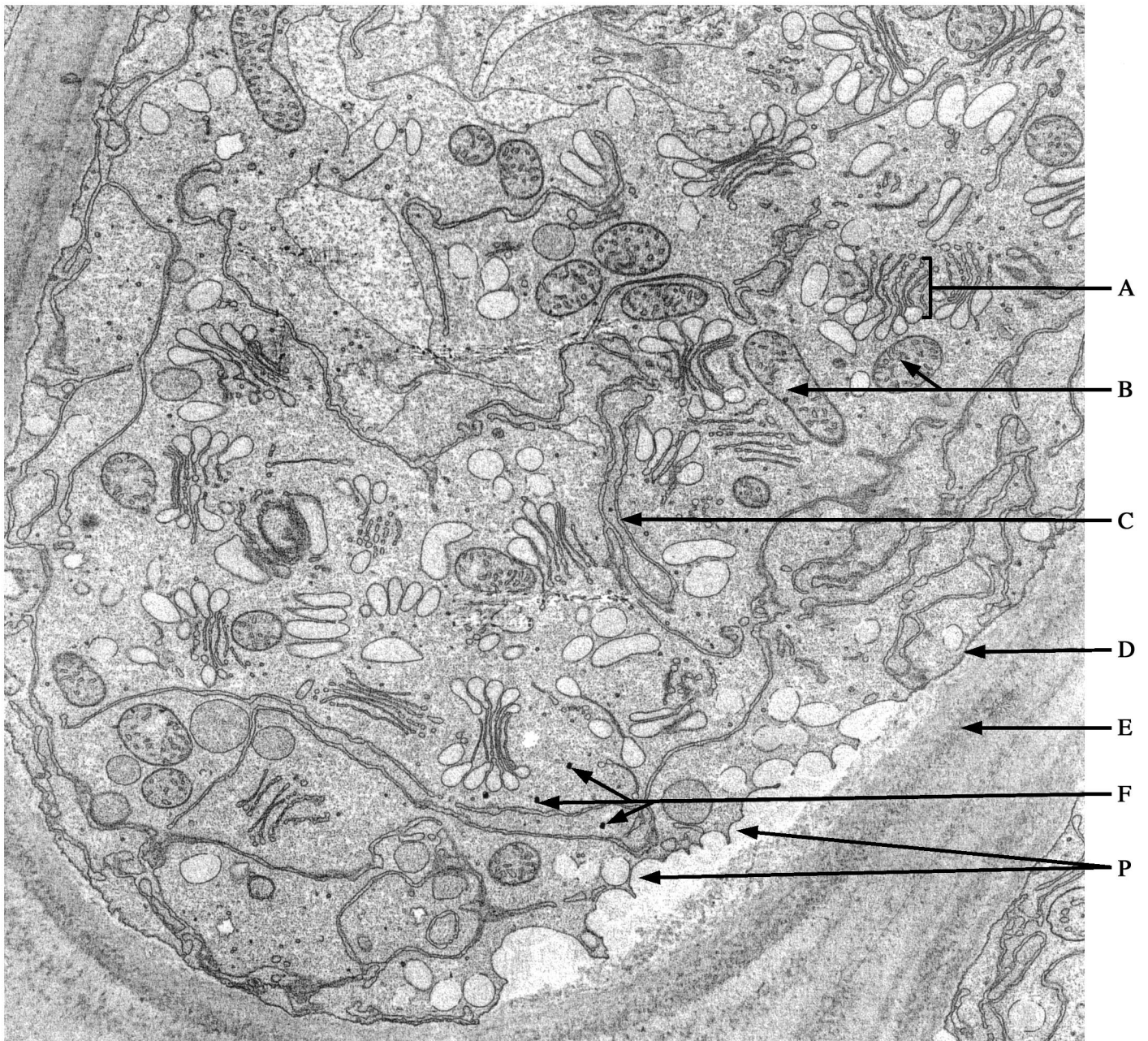
[2]

.....  
.....

**(Total 9 marks)**

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2. The electronmicrograph shows part of a **plant** cell.



Plant Physiology, Moiré, Jones, Mollenhauer. 4th Ed, 1967

(a) Identify the structures labelled **A-F**.

[6]

**A** .....

**B** .....

**C** .....

**D** .....

**E** .....

**F** .....

(b) State the name of **two** organelles or structures which may be found in plant cells, but which are not shown in this electronmicrograph. [2]

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.....

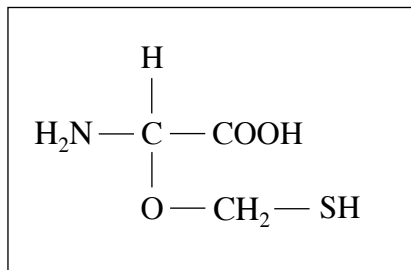
(c) Substance **P** (shown in the diagram) has been assembled in the Golgi apparatus. By means of labelled diagrams show how it is secreted from the cell. [3]

(Total 11 marks)

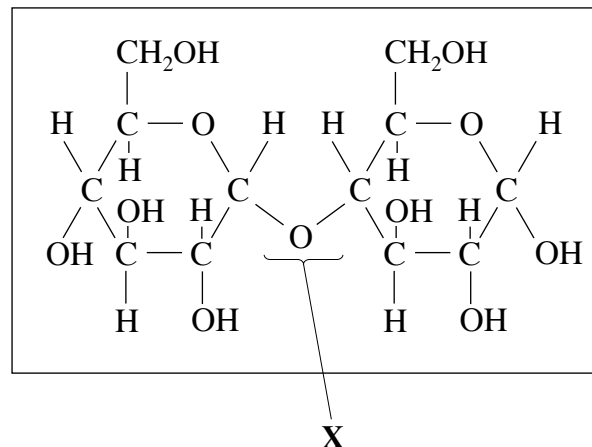
**Turn over.**

3. The following diagrams represent organic molecules.

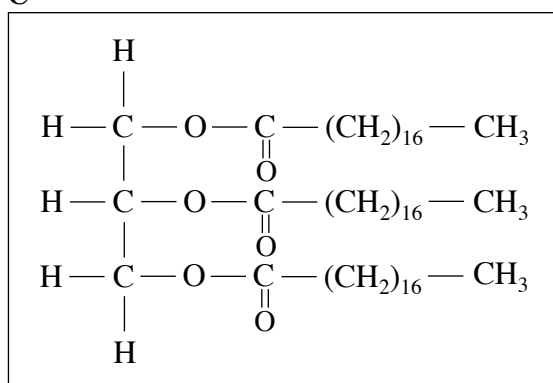
**A**



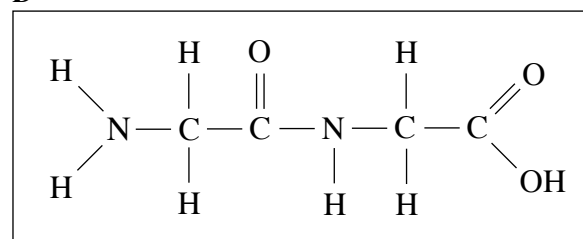
**B**



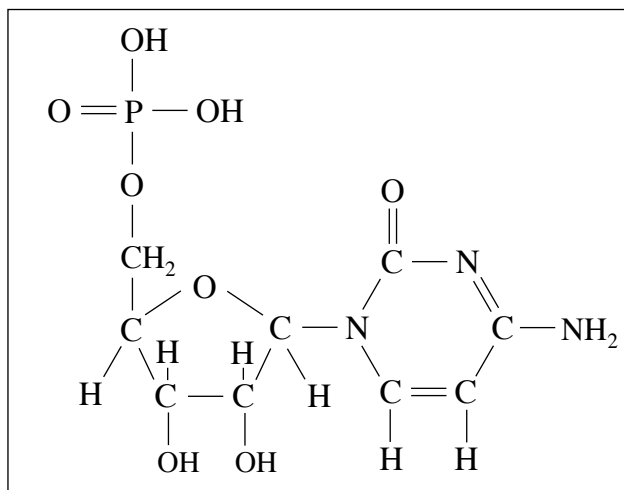
**C**



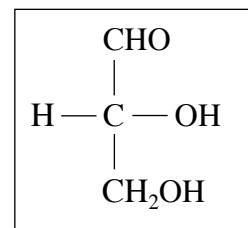
**D**



**E**



**F**



(a) Using only the letters next to the diagrams, indicate in the relevant space below which structure:

(i) contains a peptide bond? ..... [1]

(ii) contains a glycosidic bond? ..... [1]

(iii) is an amino acid? ..... [1]

(iv) is a monosaccharide? ..... [1]

(v) would require three molecules of water for complete hydrolysis? ..... [1]

(vi) is a nucleotide? ..... [1]

(b) (i) What type of reaction has formed bond **X** in molecule **B**? [1]

.....

(ii) What molecule is removed during this reaction? [1]

.....

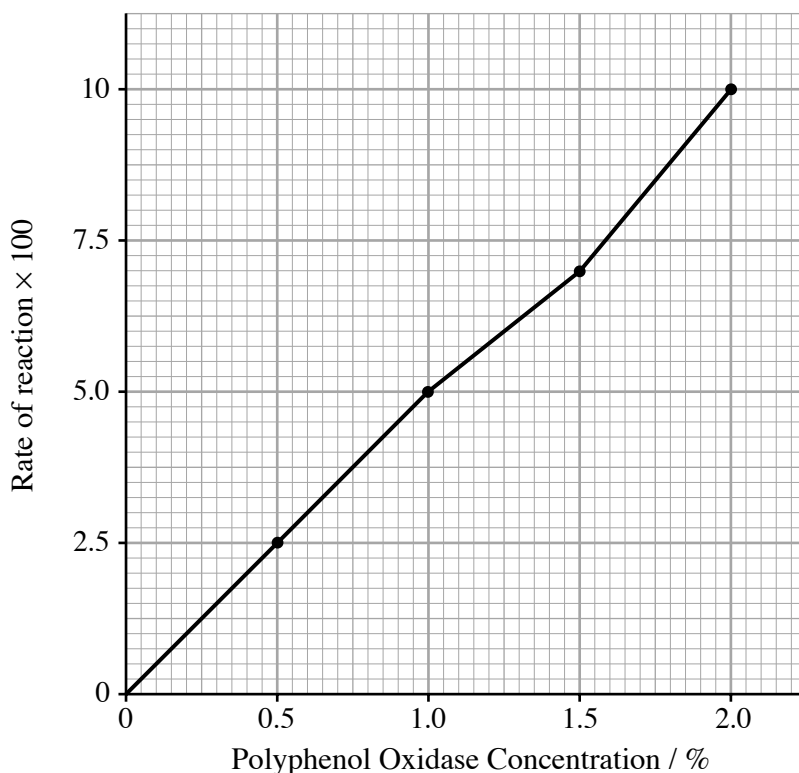
**(Total 8 marks)**

4. When a potato tuber is cut open, the surfaces exposed to the air gradually turn brown due to the production of dark brown coloured pigments from phenolic compounds (e.g. catechol). The enzyme, polyphenol oxidase, catalyses this process.

The graph below shows the results of an experiment in which different concentrations of the enzyme were added to tubes containing catechol solution. The tubes were kept at a constant temperature and shaken periodically during the experiment.

The time taken for a standard brown colour to develop was recorded and from this the rate of reaction was calculated, using  $\frac{1}{\text{time in minutes}}$  for the colour to develop.

A graph was then plotted of rate against enzyme concentration.



- (a) What general conclusion concerning enzyme action can be drawn from these results? [1]

.....

.....

- (b) At what enzyme concentration would the standard colour be obtained after 18 minutes? Show your working. [2]

.....

.....



(c) How would you set up a control tube?

[1]

.....

.....

(d) Explain why the addition of lemon juice (citric acid) to the tubes stops any colour change.

[1]

.....

.....

(e) Explain what is likely to happen to the rate of colour change if the temperature of a tube containing the enzyme polyphenol oxidase and catechol was gradually raised from 10°C to 100°C.

[2]

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.....

(f) Suggest what might happen to the rate of reaction if a competitive inhibitor were added. Explain your answer.

[2]

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(g) 'All enzymes are proteins,' describe how you would test to show that polyphenol oxidase is a protein.

[2]

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.....

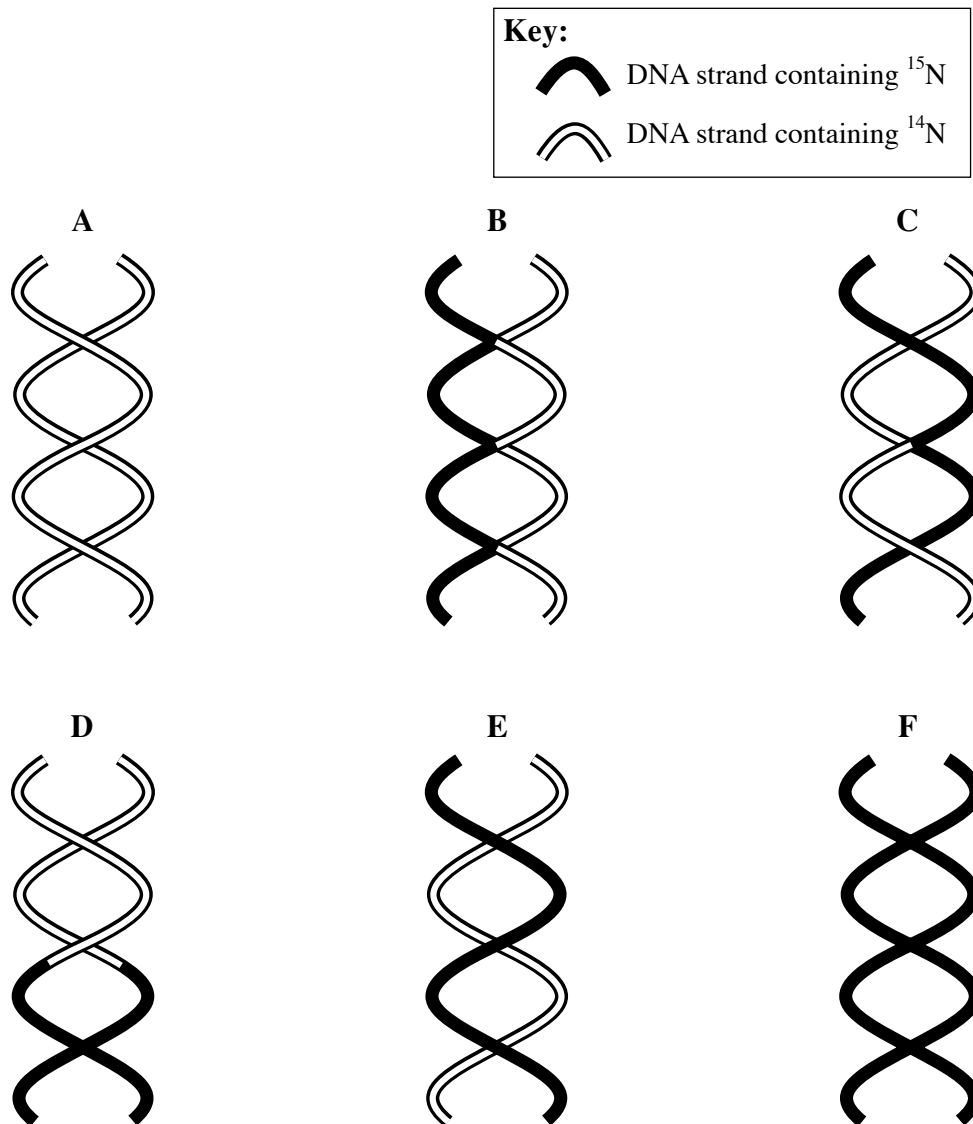
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(Total 11 marks)

5. Cells of the bacterium *E. coli* were grown for many generations on a medium containing the heavy isotope of nitrogen  $^{15}\text{N}$ . The heavy nitrogen was incorporated into the nucleotides of the DNA. The 'heavy' bacteria were introduced into a medium which only contained the normal (light) isotope of nitrogen  $^{14}\text{N}$  and samples of the bacteria were taken at time intervals equivalent to the generation time.

(a) The following diagrams represent DNA molecules indicating the nitrogen content of each.



With reference to these diagrams, indicate using the letter or letters which represent the bacterial DNA in

- (i)  $^{15}\text{N}$  bacteria allowed to divide once in a  $^{14}\text{N}$  medium [1]

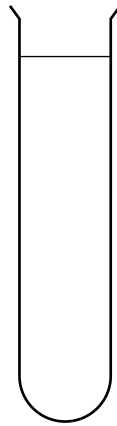
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- (ii)  $^{15}\text{N}$  bacteria allowed to divide twice in a  $^{14}\text{N}$  medium [1]

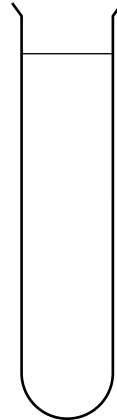
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- (b) The DNA was extracted and separated by a technique called ultracentrifugation. The position of the DNA in the centrifuge tubes was then determined.

The following diagram shows a centrifuge tube containing a gel. Draw bands to show the **relative** positions of DNA containing  $^{14}\text{N}$ , DNA containing  $^{15}\text{N}$  and the DNA extracted from  $^{15}\text{N}$  bacteria allowed to divide once in an  $^{14}\text{N}$  medium. Label your bands. [2]



- (c) On the diagram below draw bands to show the position of the DNA extracted from  $^{15}\text{N}$  bacteria allowed to divide twice in a  $^{14}\text{N}$  medium. [2]



(Total 6 marks)

6. (a) Water is a polar molecule and small clusters of water molecules are held together by hydrogen bonds.

(i) Why is water described as a polar molecule? [2]

.....

.....

.....

.....

(ii) By means of a labelled diagram, show how water molecules are held together by hydrogen bonds. [1]

- (b) Suggest why the following properties of water are important to living organisms.

(i) It is a universal solvent. [1]

.....

.....

(ii) The latent heat of vaporisation is high. [1]

.....

.....

(iii) Water has a high specific heat. [1]

.....

.....

(iv) Ice is less dense than water. [1]

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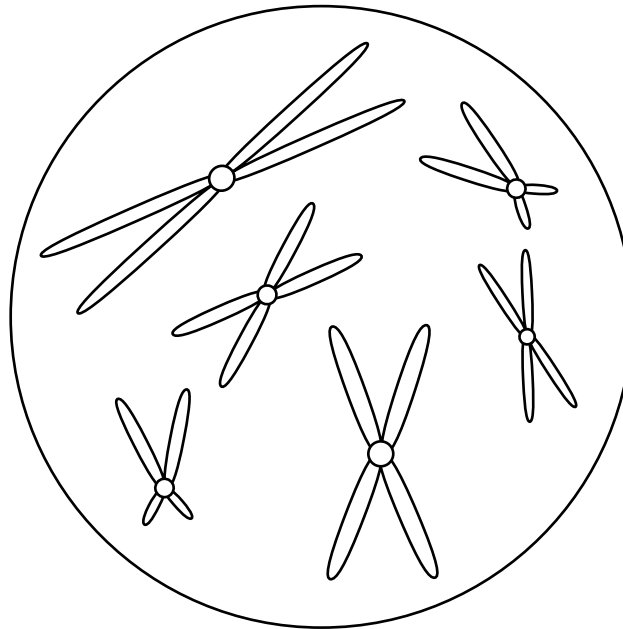
(v) Water is transparent. [1]

.....

.....

**(Total 8 marks)**

7. The diagram represents the nucleus of an animal cell ( $2n = 6$ ) at early prophase of mitosis.



- (a) In the space below draw an annotated diagram to indicate what happens to this cell at anaphase of mitosis. [4]

[3]

[illegible]

8. Answer **one** of the following questions.  
Any diagrams included in your answer must be fully annotated.

**Or** (b) Describe the structure and outline the role of **proteins** in living organisms. [10]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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